

## **314 PIPE SEWER**

### **314.01 DESCRIPTION**

Work consists of furnishing and placing reinforced PCC pipe and PVC pipe sewers, and all associated work for a complete operable pipe system.

Trench excavation and backfill are separate pay items from sewer pipe work, except for reinforced basin connections (see 310).

### **314.02 SUBMITTALS**

Shop drawings per 105.02 shall be submitted for pipe laying schedule, fittings, specials and bevel pipe.

### **314.03 MATERIALS**

PCC Pipe - 808.01(B) (Class as specified in the contract documents)

PVC Pipe - 808.02

Joint Mortar - 806.05(B)(4)

Pipe Bedding, Grading No. 57 - Table 803.02-1

### **314.04 CONSTRUCTION REQUIREMENTS**

**(A) GENERAL.** Trench excavation shall be per 207. If the actual trench width below a horizontal plane 1'-0" above top of pipe exceeds the trench design width per 207.05(A), pipe installation shall be contingent upon the Contractor's submission, and approval, of pipe design reevaluation.

The Engineer reserves the right to limit the amount of pipe laid in advance of backfilling, but in no case shall the amount exceed 100 feet for sewer work. Trench excavation shall be completed at least 25 feet in advance of pipe laying, except that a minimum of five (5) feet of completed trench shall remain at the end of a work day or at the discontinuance of work.

The District will monitor all pipe manufacturing operations; the Contractor shall notify the Engineer sufficiently in advance of pipe manufacture to facilitate monitoring.

**(B) MAINTAINING SEWER SERVICE.** Existing sewer service shall be maintained at all times. The Contractor shall conduct his operations so as to maintain sewer flows through the project area.

When necessary to pump sewage while replacing and installing relief sewers, the material pumped shall be carried by means of an approved hose or other closed, watertight conveyors to the downstream sewer or manhole designated by the Engineer. Sewage shall not be allowed to flow into or over the street surfaces. Overtime, weekend, and holiday work may be required at no additional District cost to promptly complete temporary and/or permanent sewer service.

**(C) PIPE BEDDING.** The first course of gravel bedding material shall be placed to full trench width and specified depth for proper pipe installation as shown in the Contract documents. For concrete pipe of 48-inches

and larger diameter, gravel bedding material shall be compacted with an approved vibratory compactor to the satisfaction of the Engineer.

After pipe sections have been installed per 314.04(D) or (E), remaining bedding material shall be placed, leaving no voids, and compacted under and around sides of the pipe to specified limits; pipe alignment, grade and jointing shall not be disturbed.

**(D) PIPE INSTALLATION - PCC PIPE.** Pipe shall be accurately placed to line and grade and supported uniformly throughout its entire length by the pipe bedding material. Bell holes shall be carefully excavated to provide total pipe bearing in bedding material. An approved pipe laying tee shall be used when placing pipe six (6) feet or longer in laying length. A pipe hoist, crane, or other suitable device shall be used in laying all pipe greater than 18-inches diameter. No lifting holes of any sort will be permitted in pipe.

After the pipe is aligned for coupling, the groove or bell of the preceding pipe and the spigot of the pipe ready to be coupled shall be liberally coated with an approved type of lubricant. The spigot end, with the gasket placed in the groove and relubricated after placement, shall be entered into the bell of the pipe already installed, making sure that both pipes are properly aligned. The pipe shall be then forced "home" by the use of a wedge puller or other approved means. A wedge, if used, shall be placed at least three (3) pipe lengths back from the pipe being jointed. Before the joint is fully home, the position of the gasket in the joint shall be determined by means of a suitable feeler gauge. If the gasket is improperly positioned, the pipes shall be separated and the gasket repositioned, if undamaged; damaged gaskets shall be replaced. Each section of pipe shall be laid in such a manner as to form a close, concentric joint with the adjoining section and to prevent sudden offsets in the flow line. The maximum allowable joint opening shall be three-fourths (3/4) inch; any larger opening will be cause for rejection.

After the pipes have been joined, the annular joint space remaining on the inside and outside of the pipes shall be filled with mortar and the inside joint troweled smooth.

When laying straight sewer pipe to a curved line, the opening of a pipe joint shall be limited to not more than three-fourths (3/4) inch; beveled pipe shall be used in any case where it is necessary to exceed this limit, whether the drawings note this condition or not, at no additional cost to the District.

No sand, mud, mortar, concrete or other materials shall be allowed on the inside of the sewer. Upon completion, the sewer shall be left straight, clean, smooth, and acceptable in every respect. Concrete shall be allowed to set before backfilling or walking is allowed on the sewer, and care shall be taken not to disturb the pipe bedding and joints.

During suspension of the work at night or other times, a suitable stopper shall be placed in the last pipe section to prevent earth or other foreign matter from entering.

After pipe has been installed as specified, pipe bedding material shall be placed and compacted per 314.04(C).

The balance of the trench will be backfilled per 207.

**(E) PIPE INSTALLATION - PVC PIPE.** PVC pipe shall be handled with care to avoid severe impact blows, abrasion damage, gouging and cutting by metal surfaces or rocks, and never handled with individual chain or single cable, even if padded. Exposure to sources of heat or hot objects such as heaters, boilers, steam lines, and engine exhaust shall be avoided. Gaskets shall be protected from excessive exposure to heat, direct sunlight, ozone, oil and grease. Handling techniques in cold weather require more care than during hot

weather. Each pipe unit will be inspected for straightness and damage before being installed in the work. Defective pipe and fittings shall be removed and replaced with approved materials at no additional cost to the District.

After the first course of gravel pipe bedding is placed per 314.04(C) attention shall be given to carefully placing pipe and excavating for socket joints.

Assembly of the gasket joint shall be performed as recommended by the pipe manufacturer. All joint surfaces shall be cleaned immediately before joining; the bell and beveled spigot shall be lubricated with an approved lubricant, then carefully pushed into place. A suitable device shall be used to force the pipe sections together. Good alignment of the pipe is essential for ease of assembly. Align the spigot to the bell and insert the spigot into the bell until it contacts the gasket uniformly; do not swing spigot into the bell. Generally, the spigot end of the pipe is marked by the manufacturer to indicate the proper depth of insertion. If undue resistance to insertion of the end is encountered or the reference mark does not position properly, disassemble the joint and check the position of the gasket. If the gasket is twisted or pushed out of its seat, inspect components, repair or replace damaged items, clean components, and repeat the assembly steps. If gasket was not out of position, verify or correct the location of the reference mark.

To join field-cut pipe, the pipe end shall be prepared first; a square cut is required for proper assembly. The pipe can be easily cut with a hacksaw, handsaw, or a power hand saw with a steel blade or abrasive disc. The pipe shall be marked around its entire circumference prior to cutting to insure a square cut. Use a factory-finished beveled end as a guide for proper bevel angle, depth of bevel, plus the distance to the insertion reference mark. The end shall be beveled to the correct taper using a pipe beveling tool, a wood rasp, a portable sander or an abrasive disc. Round off any sharp edges on the leading edge of the bevel with a pocket knife or a file, then assemble as stated above.

Because concrete does not bond to PVC pipe or fittings, only PVC adapters shall be used to connect to the various other types of pipe. In addition, only PVC caps or plugs shall be used to bulkhead the ends.

After the PVC pipe has been placed, the second course of gravel bedding material shall be placed around pipe haunch to provide correct alignment. The third and fourth courses of pipe bedding material shall then be carefully placed as shown in the contract documents and consolidated to avoid pipe deflection. Material shall not be dropped directly on the pipe.

Compaction equipment shall not be used directly over pipe until sufficient backfill, usually a minimum of 30-inches depth, has been placed to insure that such equipment will not damage or disturb pipes.

The balance of the trench shall be backfilled per 207.

**(F) LEAKAGE TESTS.** A leakage test shall be conducted on each completed section of all sanitary and combined sewer systems. Field leakage tests are not required for storm drain pipe.

**(1) AIR TEST.** Pipe sewer up to 42-inch diameter shall be tested with air under low pressure and will not be accepted by the District until the sewer retains the air for the specified time. Sewers over 42-inches diameter shall be air tested if approved test equipment is available per Water and Sewer Utility Administration requirements. All tests shall be conducted in the presence of District representatives.

The Contractor shall have the test equipment supplier furnish the Engineer certification that actual test equipment to be used has been calibrated and is accurate. Tests shall not commence until the certification has been accepted.

All equipment and materials required to perform pressure air testing of sewers and all expenses in connection with such tests, except for equipment specifically designated as being furnished by the District and District personnel engaged in the supervision of testing, shall be included as part of pipe sewer work.

Failure of leakage tests will require investigation and repair by the Contractor at no additional cost to the District.

The District will participate in one test and one retest, if required, of each specific section of sewer without charge to the Contractor. If additional retests are required, all costs of District personnel and equipment associated with the retesting will be deducted from the Contractor's final payment.

Before an air test is scheduled, all backfill shall be completed and trench dewatering methods discontinued. Sewers to be tested, including manholes, shall be thoroughly cleaned, free from all debris and shall be inspected for any water leakage sufficient to constitute a noticeable trickle or flow. Such leakage shall be corrected and eliminated prior to beginning the air test. Leakage tests shall be scheduled with the Engineer at least 48 hours in advance.

The air test shall conform to the following procedure:

- Test plugs shall be furnished and installed within the pipe at each manhole and shall be securely braced.
- If the pipe to be tested is expected to be below ground water table, a small diameter perforated vertical pipe shall be installed from the invert elevation of the sewer to the ground surface prior to backfilling, or a pipe probe shall be inserted by boring or driving into the backfill material adjacent to the invert elevation of the pipe, to determine the ground water level above the pipe invert immediately prior to air testing the sewer. All gauge pressures in the test shall be increased by the amount of this back pressure due to ground water submergence over the end of the probe.
- Air shall be added slowly to the section of pipe under test until the internal air pressure is raised to 4.0 psig. The air temperature shall be allowed to stabilize for at least two minutes with the pipe subjected to an internal pressure of 4.0 psig by adding only the amount of air required to maintain this pressure. After the two (2) minute period, the hose and compressor shall be disconnected completely from the pipe being tested to assure that no additional air is added.
- As a safety precaution, no one shall be allowed in manholes after the air pressure is increased in the sewer line. If the Engineer suspects that the test plug may be leaking, the pressure first shall be relieved before any adjustments are made to eliminate air leakage at the plug. The plug may be precoated with a soap solution to check the plug for leakage.
- If the internal pressure decreases, the time required for the pressure to drop from 3.5 to 2.5 psig shall be observed and recorded. This time interval shall be compared with Table 314.04-1. Pipe which fails to maintain the stipulated pressure for a period equal to or greater than the holding time shown in the table shall be deemed to have failed the low pressure air test. A sewer that fails to pass this test shall be repaired by the Contractor at no cost to the District. Following repairs, the sewer shall be retested per designated procedure.
- The Engineer will prepare a report on the required form for each section of sewer tested. The

report form shall be executed by the Contractor and submitted to the Engineer.

**(2) HYDROSTATIC TEST.** Sewers over 42-inches diameter and manholes shall be tested by the hydrostatic method if approved air test procedure is not available.

Leakage shall not exceed a rate of 100 gallons per inch diameter per 24 hours per mile of sewer.

All equipment and materials required to perform tests and all expenses in connection with such tests, except for District personnel engaged in the supervision of testing, shall be included as part of pipe sewer work.

Hydrostatic test shall conform to the following procedure:

Where ground water is encountered in the trench during construction and the water level is expected to be over the top of the sewer pipe, the completed and connected pipe shall be tested for infiltration leakage by the exact measurement of the amount of water entering it after the pumping of ground water has been discontinued for at least three (3) days.

Where the ground water level is expected to be below the top of the pipe and where the slope of the pipe between adjacent manholes will permit, the sewer shall be subjected to an internal pressure by plugging the pipe lower end and then filling the sewer and manholes with clean water to a height of two (2) feet above the top of the pipe. Upper end plugs may be needed as directed. Measurements will be made of the rate of leakage from the pipe by determining amount of water required to maintain the initial level of two (2) feet above the top of pipe. The Contractor shall provide water for this test by making arrangements with the WASUA Bureau of Sewer Services.

Each manhole and appurtenance to the system shall be watertight within the foregoing leakage limit.

Repairs to all defects responsible for leakage shall be by the Contractor at no additional cost to the District.

### **314.05 MEASURE AND PAYMENT**

The unit of measure for Pipe Sewer will be the linear foot, with measure taken along the top of the pipe complete in place, measured to inside face of sewer manhole. If profiles are included in the Contract documents, they are approximate and any variation shall not be a basis of any claim for compensation above that provided by direct measure.

Payment for the various types, classes and sizes of Pipe Sewer will be made at the respective contract unit price per linear foot complete in place, which payment will include furnishing and placing required pipe, bedding, jointing, maintaining sewer service, leakage tests, and all labor, materials, tools, equipment and incidentals needed to complete work specified.

**TABLE 314.04-1**  
**AIR TEST**  
**MINIMUM HOLDING TIME IN MINUTES AND SECONDS**  
**REQUIRED FOR PRESSURE DROP FROM 3.50 TO 2.50 PSIG**

**PIPE DIAMETER, 10-INCH THRU 36 INCH**

Length (Feet)	10	12	15	18	21	24	27	30	33	36
25	1:00	1:00	1:02	1:29	2:01	2:38	3:20	4:08	4:59	5:56
50	1:00	1:19	2:04	2:58	4:03	5:17	6:41	8:15	9:59	11:53
75	1:23	1:59	3:06	4:27	6:04	7:55	10:01	12:23	14:58	17:00
100	1:50	2:38	4:08	5:56	8:05	10:34	12:45	14:11	15:35	"
125	2:18	3:18	5:09	7:26	9:55	11:20	"	"	"	"
150	2:45	3:58	6:11	8:30	"	"	"	"	"	"
175	3:13	4:37	7:05	"	"	"	"	"	"	"
200	3:40	5:17	"	"	"	"	"	"	"	"
225	4:08	5:40	"	"	"	"	"	"	"	"
250	4:35	"	"	"	"	"	"	"	"	"
275	4:43	"	"	"	"	"	"	"	"	"
300	"	"	"	"	"	"	"	"	"	"
thru 650	4:43	5:40	7:05	8:30	9:55	11:20	12:45	14:11	15:35	17:00

**PIPE DIAMETER, 42-INCH THRU 108-INCH**

Length (Feet)	42	48	54	60	66	72	78	84	90	96	108
25	8:05	10:34	13:22	16:30	19:58	23:45	27:53	32:20	37:08	42:15	50:56
50	16:10	21:08	25:28	28:18	31:08	33:58	36:47	39:32	42:27	45:17	"
75	19:49	22:38	"	"	"	"	"	"	"	"	"
100	"	"	"	"	"	"	"	"	"	"	"
thru 650	19:49	22:38	25:28	28:18	31:08	33:58	36:47	39:32	42:27	45:17	50:56